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among themselves, and to other stellar objects. These questions must be left for the future.¹

E. A. FATH.

MT. HAMILTON, December, 1908.

NOTE ON THE CLASSIFICATION OF DOUBLE STARS.

Lick Observatory Bulletin, Number 158, contains another list of one hundred new double stars discovered and measured with the 36-inch telescope. This list brings the total number of my published discoveries to two thousand. Arranging these stars according to their angular separation, we have the following table:—

Distance	No. of Pairs	Percentage
0".25 or less	182	9.10
0 .26 to 0".50	444	22.20
0 .51 to 1 .00	400	20.00
1 .01 to 2 .00	450	22.50
2 .01 to 5 .00	511	25.55
5 .01 or greater	13	0.65
	<hr/> 2000	<hr/> 100.00

From this table it appears that more than one half (51.3%) of the stars listed belong to STRUVE's Class I (distance 1" or less), and that nearly three fourths (73.8%) fall within the 2" limit. The thirteen pairs which exceed the limit 5".0 have components whose difference in brightness averages 5.7 magnitudes. In only three cases does the angular separation exceed 5".2. Though the program of my survey contemplates the systematic examination of the stars only to the magnitude 9.0, inclusive, it is inevitable that fainter stars should from time to time be brought into the field of the telescope. In this way many fainter pairs have been discovered, but, in general, only the very close ones have been listed. In all, I estimate that considerably less than 10 per cent of the pairs published have components whose combined brightness falls below 9.0 B. D. magnitude.

¹ The publication of the above paper was unavoidably delayed. Since it was written Professor BARNARD has published the results of a photographic investigation of the *Hercules* cluster in the *Astrophysical Journal*, **29**, 72, 1909. He finds that this cluster is composed of stars of different spectral types. The spectrographic results obtained by the writer are in agreement with this.

E. A. FATH.

March, 1909.

Excluding the stars south of -30° Declination, I find by examining the various double-star catalogues that there are about 7,500 known pairs with measured distances of $5''$ or less. This is an estimate only, but as care was taken to include all published lists and to make the estimates liberal I think the number given is certainly large enough. Of this number about 4,400 have distances under $2''$, and 2,550 of these are under $1''$. These figures are more nearly exact than the general total. The survey now in progress at this observatory has contributed 3,300, 2,460, and 1,700, respectively, to these totals. Nearly 60 per cent, therefore of the 7,500 pairs under $5''$ are under $2''$, and this percentage will be raised at the completion of our survey, for nearly 75 per cent of the 3,300 pairs already found here belong to the closer class. In other words, the actual number of very close double stars (distances under $2''$) greatly exceeds the number with moderate separation (distances between $2''$ and $5''$). We are, of course, reasoning from incomplete data, but so far as this affects our argument it favors the opposite conclusion, for it is the exceptionally close pairs and those under $2''$ with one component relatively faint which are the ones most likely to have escaped detection. The spectroscopic binaries must also be taken into account and they all belong to the very close pairs. Keeping in mind the proportion of the known spectroscopic binaries to the stars whose radial velocities have been measured, and remembering that this percentage is certain to be increased by the addition of spectroscopic binaries hitherto undetected because of smaller range of radial velocity or longer period, it is safe to say that the double stars (visual and spectroscopic), among the stars to the magnitude of 9.0 inclusive, with distances under $2''$ outnumber those with distances between $2''$ and $5''$ in the proportion of 3 to 1.

This conclusion, based upon data supplied by observation, confirms in the strongest manner the argument from the theory of probabilities that practically all of the closer double stars are binary systems. Certainly we may reasonably assert that a double star with an angular separation of less than $2''$ is a binary until the contrary has been demonstrated instead of suspending judgment until definite orbital motion has been observed.

R. G. AITKEN.

MT. HAMILTON, April 29, 1909.